Displacement of Black Flying-foxes *Pteropus alecto* from Batchelor, Northern Territory

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ABSTRACT

This paper reports upon an operation to displace camps of Black Flying-foxes *Pteropus alecto* using non-lethal methods from the town of Batchelor. The flying-foxes showed a preference for camping in African Mahogany trees *Khala senegalensis*. Flying-foxes were dispersed by a team of Parks and Wildlife staff and community volunteers using a combination of smoke, non-lethal plastic shot and noise. The flying-foxes ceased roosting in the town during the operation but continued efforts were required to ensure that flying-fox camps did not re-establish within the town. The use of methods for dispersal, the removal of camp trees and public relations are discussed.

Key words: Flying-fox, pest, control, urban, wildlife, *Pteropus alecto*

Introduction

Flying-foxes *Pteropus* spp. are a prominent component of the urban fauna in eastern and northern Australia (Parry Jones 1987; Markus and Hall 2004). Flying-foxes typically roost during the day in communal camps that range in size from just a few individuals to hundreds of thousands of bats and they may be occupied seasonally or intermittently over long periods (Parry Jones 1987; Palmer and Woinarski 1999; Vardon *et al.* 2001; van der Ree *et al.* 2006). Flying-fox camps are conspicuous features of urban landscapes because of their strong acrid odour and the collectively loud noise made by flying-foxes during the course of their social interactions. Flying-fox camps are noisiest in the early evening and early morning when the bats depart to forage and return from foraging, respectively.

In urban areas flying-fox camps frequently occur in remnants of bushland where they cause little disturbance to the human population. However, in some cases flying-fox camps may be established in areas where they adversely affect people or their interests (Vardon *et al*. 1997; van der Ree *et al*. 2002a; Tidemann 2003; Eby and Lunney 2002). In such cases, the displacement of flying-fox camps may be necessary to eliminate the smell and noise of the colony, the damage that they cause and to minimize the risk that flying-foxes may pose to human health.

Displacing flying-fox camps without causing unnecessary death or suffering is a task that wildlife managers working in areas with large flying-fox populations are likely to have to undertake. There have been several reports in the literature of attempts to displace flying-fox camps from urban areas. Some of these attempts have resulted in animals dispersing from the roosts (Tidemann 2003) and others have not (Vardon *et al.* 1997; van der Ree *et al.* 2002a, b, c). These reports detail the use of many different methods to displace the flying-foxes, including shooting with lethal and non-lethal shot, loud noises, ultrasonic noise, smoke, hosing and helicopters.

Many wildlife managers have reported having difficulties in displacing flying-foxes using non-lethal methods. These difficulties have been attributed to the strong site fidelity displayed by individual flying-foxes, the large number of flying-foxes present in some camps, animal welfare concerns, being unable to garner the support of local communities and attracting protest from lobby groups opposed to the displacement efforts (Vardon *et al.* 1997; van der Ree *et al.* 2002a, b, c, Smith 2002).

In this paper we report an operation to displace a black flying-fox camp from Batchelor (13°02'55"S, 131°01'45"E), Northern Territory during 2003/2004. Batchelor is a town of approximately 400 people. The vegetation of Batchelor consists of a mix of introduced and native species and lawns and is typical of towns in tropical Australia. The vegetation with a 25 km radius of Batchelor is largely tropical savannah (Brock 2001) that has not been cleared. Areas that have been cleared in the vicinity of the town include fruit orchards, timber plantations and improved pastures. The Finniss River runs near the town and its banks support riparian vegetation that is typical of streams in the Top End of the Northern Territory (Brock 2001).

The flying-fox camp in Batchelor had been present for about 10 years prior to the operation. Discussions with residents suggest that the camp had grown in size over time with a commensurate increase in the impact of the bats on the residents' quality of life. In particular, the residents complained about the noise, unpleasant smell and perceived health hazard of the camps. The operation to remove the town's flying-foxes comprised three complementary components: population monitoring, public relations and displacement operations. Each was essential to the successful displacement of flying-foxes from Batchelor.

The Batchelor Flying-fox Camp

Flying-fox camps were in trees surrounding five residences in the Batchelor township. The majority of the flying-foxes were camped in African Mahogany trees (approximately 25 m in height) at two residences. These trees were emergents above the surrounding vegetation canopy and were surrounded by a dense mid-storey of vegetation (15-20 m in height) comprising of *Terminalia* spp., *Ficus* spp., bamboo *Bambusa* spp. and mango *Mangus indica* trees.

Reports from the community indicated that flying-fox numbers peaked during the dry season each year when both males and females with young congregated in Batchelor. The town's flying-fox population declined during the wet season (December–March) when most of the bats camped outside of the town. This is the period when the population is normally low, and it precedes the period before adults with young have repopulated the camps. The exact location of camps outside of the town was not known. Flying-foxes frequently camp in riparian areas and it is likely that camps would be located on the banks of the Finniss River. The wet season was considered to be the most suitable to conduct the displacement operation because previous operations had shown that is easier to displace smaller groups than larger groups of bats (P. Hauser pers. obs.).

Population monitoring

The population-monitoring program commenced on 25 September 2003. It aimed to: 1) establish baseline data on the population within Batchelor; 2) indicate when numbers declined to a level that would make the dispersal efforts possible logistically; and 3) determine the success of the displacement operations.

Three locations were chosen as the principal population monitoring sites. These sites had the highest concentrations of flying-foxes. To achieve consistency, the counts were conducted from permanently marked sites and were conducted by two people. The population count data were calculated as the average score of the two observers. Counts were conducted at 1500 h on weekdays for a period of two weeks until 9 October 2003. Twice weekly counts were conducted from 13 October 2003 to 13 November 2003. Weekly counts were undertaken between 13-28 November, 2003. No counts were undertaken between 28 November and 8 January 2004. Following 8 January 2004, counts were conducted in response to operational requirements. In addition to the counts at the monitoring sites, the number of individuals at other locations within the towns was also recorded.

Public relations

Recent efforts to move flying-foxes from their camps in Maclean, NSW (West 2002), Melbourne Botanical Gardens, Sydney Botanical Gardens (Richards 2002) and Katherine, NT (Vardon *et al.* 1997) were met with a mix of public support, criticism and objection. In some cases, the dispersal efforts were more of a nuisance to some stakeholders than the actual presence of the flying-foxes and the efforts attracted negative media attention.

Given the mixed public relations success of previous displacement efforts, planning and community liaison was identified as a key component of the Batchelor operation. The local government in the area, Coomalie Community Government Council, established a flying-fox committee that comprised concerned local residents. Its role was to liaise with the local community, participate in the planning of the displacement operation, and coordinate the efforts of the local community and to liaise with staff from the Parks and Wildlife Service of the Northern Territory (PWSNT).

To facilitate public support for the displacement plan, the flying-fox committee and PWSNT staff conducted the following actions. A residents' information brochure was prepared and distributed outlining the dispersal plan. A door-knock consultation advising residents of planned operations was conducted throughout the town. A media release and public notice were prepared for local media; and a community meeting was held to obtain residents' consent to conduct the displacement operation.

These consultations aimed to inform the community of Batchelor that the dispersal efforts would be noisy and would be conducted in the early hours of the morning. They would also involve the use of smoke, and that asthma sufferers should take particular care and it would involve the use of firearms discharging non-dangerous cartridges. The residents were also advised that the operation may disperse flying-foxes to other parts of Batchelor, and that the operation aimed to maintain high standards of animal welfare and did not aim to deliberately injure or kill any flying-foxes.

Planning the displacement operation

A plan to disperse the colony during the months of December and January was agreed to by PWSNT, residents and the Coomalie Community Government Council. The timing was determined by literature reports of flying-fox ecology, discussions on the historical use of the town by flying-foxes, and the population-monitoring program. The displacement operation was timed to coincide with the annual decrease in flying-fox numbers that had occurred each wet season in Batchelor, and it was also timed to predate the birth of flying-foxes. Juveniles are normally present from February to March each year. The operation was planned to last for days, and potentially weeks, and it was to be conducted simultaneously at all known camps within the town.

The displacement operation used a number of non-lethal methods. This was considered necessary because previous operations had reported that flying-foxes may become habituated to some displacement methods and that the use of only one displacement method was likely to result in failure (Vardon *et al.* 1997; van der Ree *et al.* 2002a, b, c). To minimise harm to juvenile flying-foxes, it was decided that no physical disturbance methods were to be used if females with young were present. Residents were encouraged to participate in the dispersal effort by initiating some of the non-physical dispersal techniques in their own residences. During the operation, the following methods were used:

1) Smoke. Smoke produced by burning leaves under camps was conducted in the early morning when the wind was low. A 200 litre steel fuel drum, with the top removed and breathing holes cut into the bottom, was used and provided a portable burning platform. Where possible, smoking was conducted simultaneously at all camps.

2) Noise. Flying-foxes were shifted from the Maclean NSW using a large number of people making loud noises (Tidemann 2003). This method was used in Batchelor. Noises used included banging of drums and metal garbage can lids and the beating of tree branches. Noise-making sessions were conducted in conjunction with the smoke drums in the early morning when flying-foxes were returning to the camps. Noise-making was conducted simultaneously at all known campsites.

3) Plastic bead shot and bird-frite. Explosive “bird-frite” cartridges, fired from a 12 gauge shotgun, have been used previously to disperse flying-foxes. These cartridges fire a time-fused charge that creates a loud noise in the canopy. The explosion frightens flying-foxes.

The PWSNT has also developed a non-lethal plastic bead shot that can be fired from a 12 gauge shotgun. The cartridge combines explosive noise with non-lethal shot. This method has proved to be a safe and effective way to move flying-foxes from their campsites and away from potential landing sites. These cartridges are effective in areas where flying-foxes are located high in trees.

Conducting the displacement operation

In February 2004, the number of flying-foxes in Batchelor was low (approximately 200). Scrutiny of the flying-foxes indicated that approximately 95% of them were males. Subsequently, it was decided to commence the displacement operation on the weekend starting 21 February 2004. A weekend was chosen because more volunteers would be available to participate and it would cause less disruption to residents than on a weekday. Volunteers rose early in the morning, and by 0530 h they had lit fires in drums placed under the main roost trees. PWSNT staff fired bird-frite cartridges and plastic shot cartridges. Fifty bird-frite cartridges were used. The bird-frite cartridges were a useful tool for herding the bats in a desired direction. By 0630 h, a few small groups of 5-10 flying-foxes continued to try and roost in different parts of town. These flying-foxes were harassed with bird-frite and plastic shot to prevent them from settling within the town. The operation lasted until 0930 h when the majority of the flying-foxes were observed to leave the town area.

The smoke drums were lit each morning under the main roost trees as the flying-fox colony continued to attempt to roost. On the second morning, about 75 flying-foxes attempted to camp in the town. After one week of operations, the flying-fox population within the town was 30 individuals. They were camped at sites that were not occupied when the operation began on 21 February 2004.

By 3 March 2004, during a period of heavy and prolonged rain, larger numbers of flying-foxes returned to the town (Fig. 1). On the morning of 4 March 2004, approximately 250 flying-foxes attempted to camp in the town. The smoke drums continued to be deployed and PWSNT used about 30 bird-frite and plastic bead shot cartridges to assist with the dispersal. By early morning, most flying-foxes had moved away from the town.

As the operation progressed over the ensuing weeks, flying-foxes attempted to camp at other locations within the town (Fig. 1b). However, the numbers generally remained low (Fig. 1a). Residents affected by flying-foxes were encouraged to light smoke drums and use noise to move them on. A group of 200 flying-foxes returned to the town on 29 July 2004. This camp was subsequently moved on by town residents using smoke.

Details of the effort calculated in person hours expended during the Batchelor displacement operation is shown in Figure 2. The effort expended decreased over time, reflecting the decrease in the number of flying-foxes attempting to roost in the town.

Discussion

The Batchelor flying-fox displacement operation was regarded as being successful in terms of reducing flying-fox numbers, animal welfare and public relations matters. However, we note that because we did not use controls or replicate aspects of the removal program, it is not possible to empirically evaluate the effectiveness of the dispersal techniques, nor is it possible to conclusively attribute the success of operation to the dispersal efforts. These limitations were necessitated by the fact that its purpose was to displace flying-foxes from the town and it would not have been feasible logistically, or from a public relations perspective, to establish control areas within the town. Noting these limitations, we discuss aspects of the operation below.

The results of the operation confirm previous reports that suggest that smoke can be an effective method of displacing flying-foxes (Vardon *et al.* 1997; Environmental Protection Agency 2004). Advantages of using smoke are that it can be cheap to produce, commercially manufactured smoke/fog machines can be used to generate smoke, it does not require special training of operators, and it appears to cause the flying-foxes little direct harm. Potential disadvantages are that it may require the use of safety equipment, natural sources of smoke may not be available, it may not be useful during periods of windy weather, it may adversely affect neighbours and, in some areas, may breach environmental regulations.

Although the Batchelor displacement operation was effective in terms of the methods used, animal welfare and displacement of the camps; there are several issues that should be addressed in the event of future operations in Batchelor, or elsewhere. Any operation limited to the use of noise or physical disturbance methods should be regarded as an ongoing operation that will require continued efforts and the ongoing support of residents in the event of flying-foxes returning to the camp-sites. In the case of Batchelor, a significant number of flying-foxes returned to the town

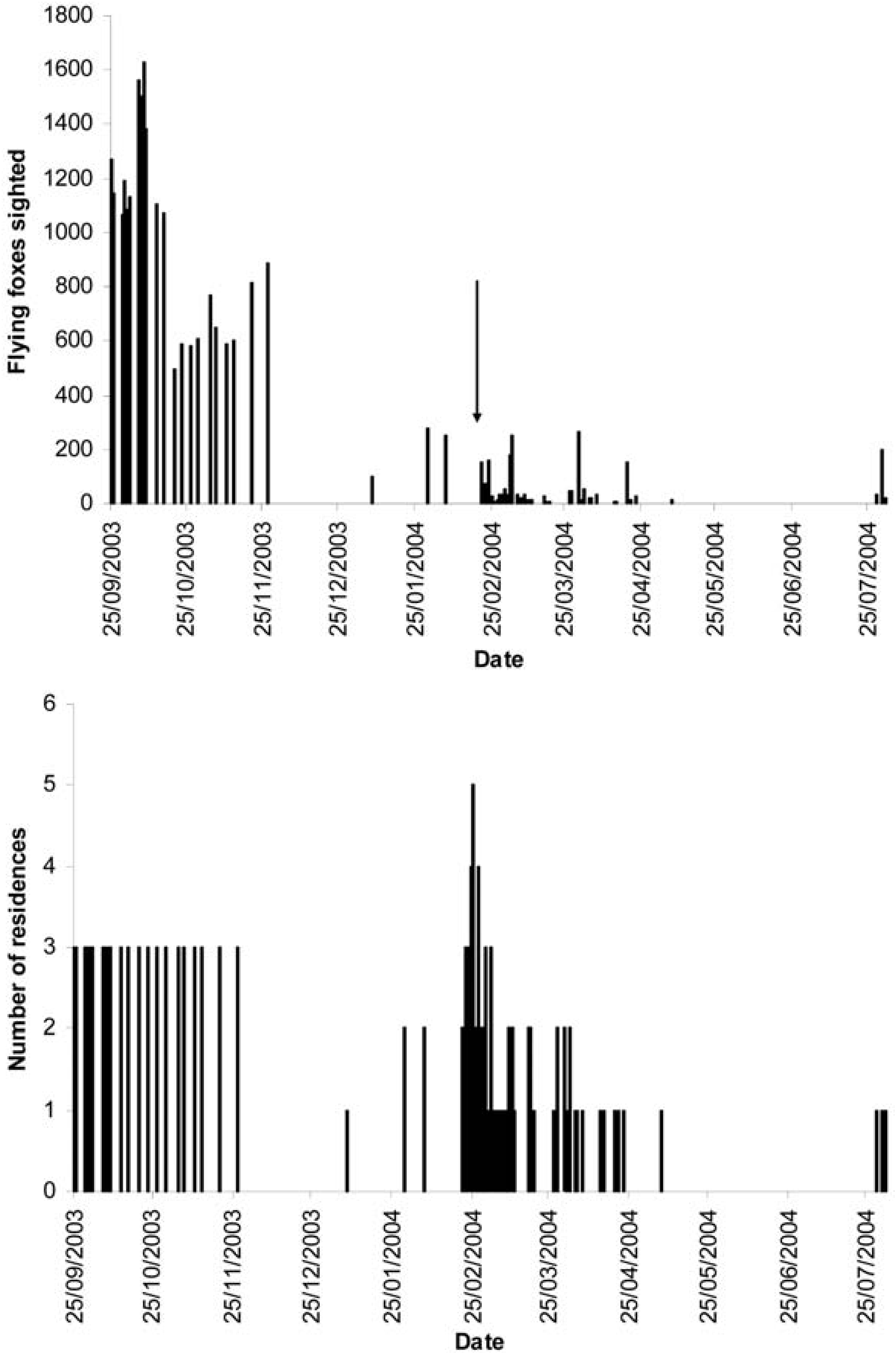

Figure 1. Flying-fox sightings (a) and the number of residences (b) utilised by flying-foxes in Batchelor between 25 September 2003 and 3 August 2004. The arrow in (a) indicates the commencement of the displacement operation on 21 February 2004.

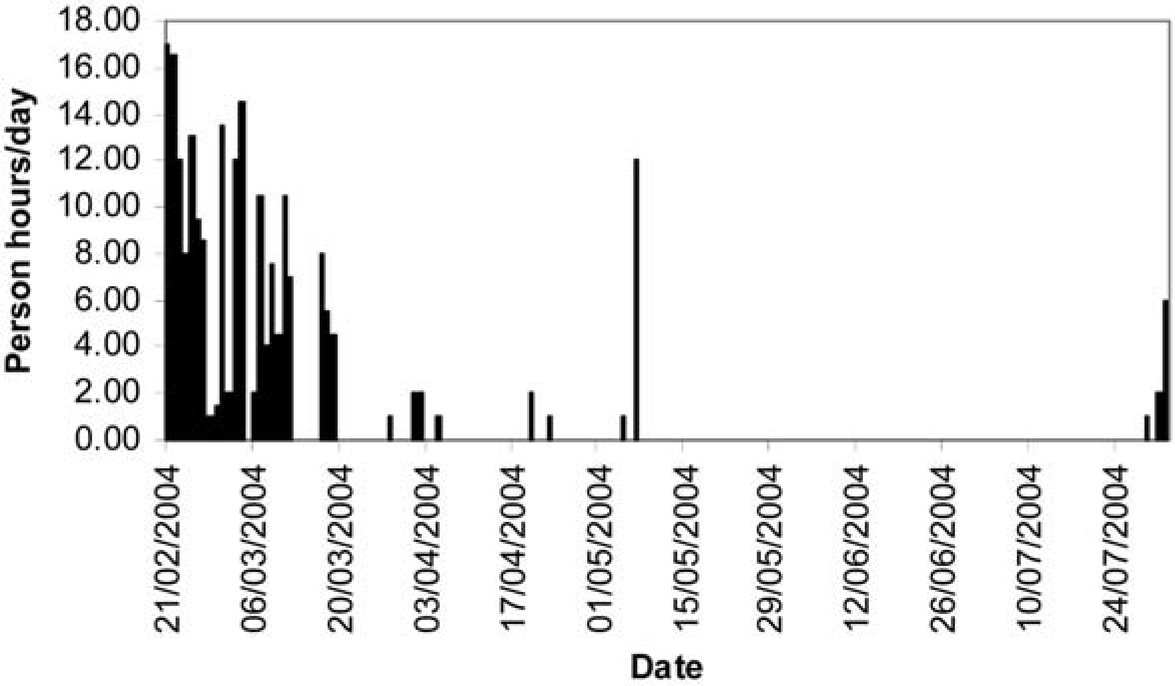

Figure 2. The effort expressed in person hours/day used during the displacement of flying-foxes from Batchelor between February and August 2004.

in July 2004. Furthermore, operations based on noise and physical disturbance are likely to be labour intensive and, for this reason, may lose the support of residents who may become dismayed if their efforts are unsuccessful or achieve only incremental success.

Given the likelihood that flying-foxes would return to Batchelor following the displacement operation, it was identified during the planning phase that a longer-term solution to the town's flying-fox problem would be required. The most feasible strategy would be to remove or lop emergent African mahogany trees, particularly those known to host flying-fox camps. These trees are utilised by flying-foxes in urban areas throughout the Top End of the Northern Territory and it is likely that if they are removed the flying-foxes will seek shelter elsewhere. However, removal of these large trees is expensive and may be considered undesirable by landowners and local governments. Nonetheless it is recommended that, in areas with persistent flying-fox problems, African mahogany trees and other trees favoured by flying-foxes be lopped or removed in order to remove potential camp sites. In the case of Batchelor, several African mahogany trees that were known to be camp-sites were removed during the dry season of 2004. Subsequent observations indicate that their removal has helped to alleviate the town's flying-fox problems.

The Batchelor operation, and other operations conducted throughout Australia, indicate that public support, participation and awareness is essential to their success (Tidemann 2003). In the case of Batchelor, the communication strategy failed to reach the entire population and resulted in some residents making complaints about the noise and timing of the operation (Burton 2004). This communication breakdown briefly interrupted the displacement operation and highlighted just how important it is to ensure that all residents and stakeholders are adequately informed prior to the commencement of a displacement operation.

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